

eg. A 60.0 kg student runs up 23 stairs that are 36.0 cm wide and 18.0 cm high. If it takes 3.0 s,
a) what is the weight of the student?

$$\text{weight} = F_g = mg = 60.0\text{kg} \times 9.81\text{N/kg}$$
$$60 \times 9.81 = 588.6 = 589\text{N}$$

a) what is the work done against gravity by the student?

$$W = Fs = 588.6\text{N} \times (23 \times 0.180\text{m})$$

ignore the sideways motion

$$588.6 \times 23 \times 0.18 = 2,436.804 = 2.4 \times 10^3 \text{ J}$$

a) What is the power of the student? convert into horsepower 1hp=746W

$$P = W/t = 2436.804/3 = 812.268$$

$$812.268/746 = 1.0888 = 1.1 \text{ hp}$$

a) What is the work done by gravity?

= $-2.4 \times 10^3 \text{ J}$ negative because the force is opposite the displacement

F is down s is up

a) What is the work done by the normal force?

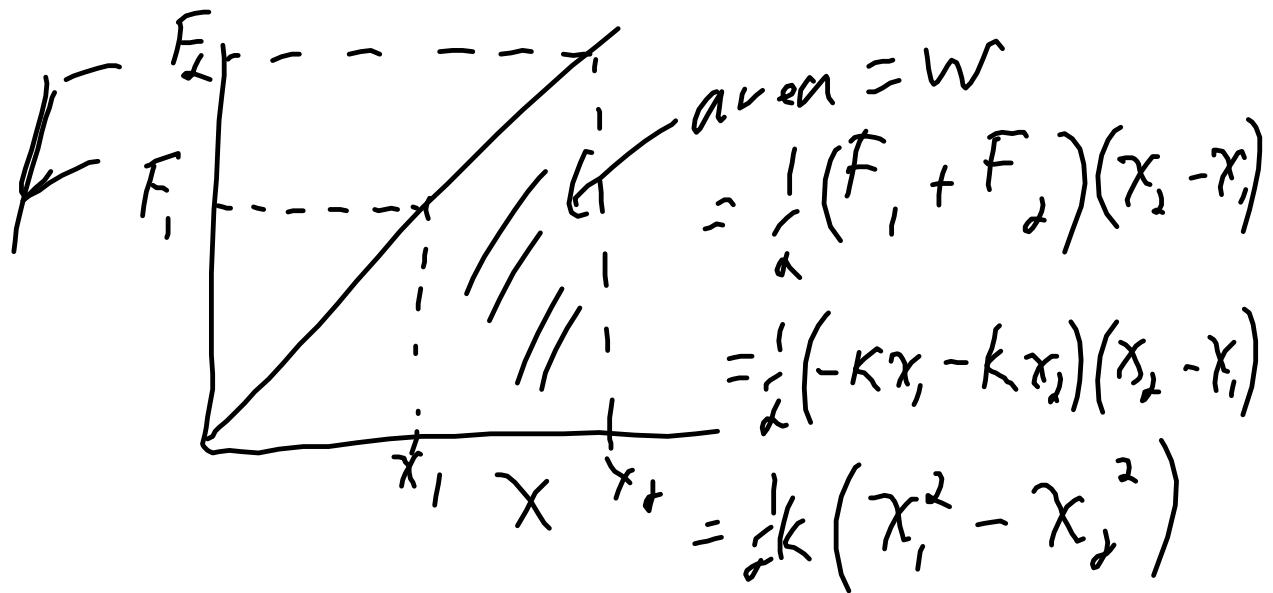
W=0 because the floor isn't moving

1. What is the work done against a spring, $k=2.0$ N/cm pulling it from $x=3.0$ cm to $x=5.0$ cm?

$W=Fs$ only valid if F is constant

$$F=-kx$$

W = area under the F - s graph



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$$W = \frac{1}{2} k x_1^2 - \frac{1}{2} k x_2^2 \quad \text{by the spring}$$

$$W = \Delta E_{\text{spring}}$$

$$E_e = \frac{1}{2} k x^2$$

↑ elastic energy

$$\int \frac{dE_{\text{spring}}}{dx} dx$$

$$1 \dots \frac{1}{2} (2.0 \text{ N/cm}) (3.0 \text{ cm})^2 - \frac{1}{2} (2) (5)^2$$

$$W = -16 \text{ J by spring}$$

$$\boxed{W = 16 \text{ J}} \text{ against the spring}$$

$$F_g = \frac{GMm}{r^2}$$

Efficiency - useful work or energy or power from input work or energy or power

$$\text{Efficiency} = W_{\text{out}}/W_{\text{in}} \times 100\%$$

- eg. 1. You lift a 1.0 kg mass up 1.0m. You could also use a pulley to lift the mass. You exert 1.2N on a string to lift the mass the same distance. What is the efficiency of the pulley?
2. You leave a 100 W light bulb on for 8 hours a day for a year. If BC Hydro charges 10 cents per kilowatt-hour, how much does it cost to have the bulb on? If you replace the bulb with high efficiency bulb that only uses 25W to give the equivalent light, how much money do you save a year?

3. Run up the stairs and determine your power.
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